

after splicing. The approach span end segments and the center span drop-in segments were supported by the haunched pier segments during construction prior to post-tensioning.

The bridge has an 8.5-in.-thick, cast-in-place concrete deck. The roadway barriers are 4 ft 6 in. high with concrete bases and a steel railing, and the pedestrian railing for the shared-use path is 4 ft high with a concrete curb section and steel railing.

The project also includes approximately 600 linear ft of retaining walls on the roadway approaches to the bridge. Mechanically stabilized earth walls are used on the east approach and cast-in-place concrete walls on the west approach.

A pedestrian underpass beneath the west approach embankment provides connectivity along the existing riverwalk on the west bank of the Christina River; a set of cast-in-place concrete stairs connects the multimodal path on the bridge and the riverwalk below. The underpass has a cast-in-place concrete frame, about 50 ft long and 45 ft wide, with an arching ceiling, full lighting, and panels for future displays of artwork.



Erection of an end girder segment in span 1 from the working platform. Note the preinstalled strongback at the pier end of the segment and the end block for post-tensioning anchorages at the abutment end of the segment. The end detail of the girders at the abutments was modified at the request of the precaster because, in their experience, the small piece of the top flange that extends beyond the end block has a tendency to crack at the interface. Photo: R.E. Pierson Construction Company.

Aesthetic Considerations

Given this bridge's prominent location as a focal point within the riverwalk development, the aesthetics of the structures were deemed quite important. As noted, the geometrics of the bridge (low profile, convenient access, and unencumbered views of the downtown skyline) were critical elements in the bridge's siting and design. As the design evolved, other elements were added to enhance the aesthetics. Bridge piers were shaped and contoured. Abutments and retaining walls were developed

in tandem to ensure a coordinated appearance, especially in the transition areas. Concrete surfaces on the piers, abutments, and walls received stone formliner treatments and were stained for maximum, but subtle, effect. The multimodal underpass, stairway, and adjacent walls were all detailed and treated to coordinate with the bridge detailing, presenting a uniform, pleasing appearance.

Geotechnical Challenges

The site was contaminated with heavy metals, a legacy of past industrial use.



AESTHETICS COMMENTARY

by Frederick Gottemoeller

In bridge design, seemingly intractable physical or functional constraints are often a blessing in disguise. Satisfying them allows—indeed requires—creative imagination. Often, the result is a distinctive and memorable bridge, like the Christina River Bridge. The designers had to keep the profile low while ensuring the structure would meet navigation requirements and accommodate future increases in sea level. That left a 45 in. window for the girder depth, which was far too shallow to cross the 180-ft main span with conventional precast concrete girders. Designers of steel bridges commonly solve such constraints with continuous haunched girders, but the Delaware Department of Transportation (DelDOT) wanted a low-maintenance concrete bridge.

Therefore, the designer modified standard precast concrete girder sections to provide haunched sections over the piers and then post-tensioned them together with standard drop-in sections to make girders that are continuous for both live and dead loads. This concept doesn't just solve the clearance problem—it also allows the bridge's shape to express the way the forces on it vary over its length, making a graceful structure that is interesting for waterfront users to view. The shape is enhanced by the gentle arch created by the crest vertical curve. The curve is as long as the bridge itself, much longer than what would be required by stopping-sight distance alone.

The project also encourages pedestrian and bicycle travel along the river by providing an

unusually attractive underpass. Users can see all the way through that underpass from each end, and it is as wide as its approach pathways. There is no threat of being hemmed-in or trapped. The light-colored reflective concrete surfaces let daylight reflect far into the underpass and are easily lit at night. Thus, the underpass always looks bright and inviting. Finally, differentially staining the retaining walls' formliner "stones" ensures that they look like and have the same aesthetic impact as the real thing.

DelDOT's goal for the Christina River Bridge is to catalyze the redevelopment of Wilmington's downtown riverfront in functional, aesthetic, and symbolic terms. I'm confident that visitors to Wilmington 10 years from now will find that the bridge has done exactly that.

EDITOR'S NOTE

A special thanks to Fred for this 50th Aesthetics Commentary in ASPIRE.